form alternating regions of magnetic and nonmagnetic metals on the surface of the substrate.

[0010] The invention provides a plurality of magnetic stripes of soft magnetic material spaced apart for controlled magnetostatic coupling therebetween to obtain opposite alignment of the magnetization of adjacent stripes in zero magnetic field.

[0011] The invention further provides an apparatus for sensing a magnetic field wherein the magnetic field required for magnetic saturation depends on the magnetostatic coupling which can be controlled by way of the geometry of the magnetic stripes and their spacing.

[0012] The invention further provides an apparatus for sensing a magnetic field wherein the magnetic stripes are made of soft magnetic materials such as iron, nickel or alloys thereof having high permeability, low coercive force and small hysteresis loss so that the anisotropy magnetic fields are small and do not dominate the magnetic saturation field as in granular films. The distance between the magnetic regions or between magnetic stripes is large enough such as 100 Å such that the magnetic stripes are not strongly exchanged coupled to the adjacent magnetic stripe respectively.

BRIEF DESCRIPTION OF THE DRAWING

[0013] These and other features, objects, and advantages of the present invention will become apparent upon consideration of the following detailed description of the invention when read in conjunction with the drawing in which:

[0014] **FIG. 1** is a first perspective view of a first embodiment of the invention.

[0015] **FIG. 2** is a second perspective view of a second embodiment of the invention.

[0016] **FIG. 3** is a perspective view of a second embodiment of the invention.

[0017] **FIG. 4** is a first top view of **FIG. 3**.

[0018] **FIG. 5** is a second top view of **FIG. 3**.

[0019] **FIG. 6** is a top view of a third embodiment of the invention.

[0020] **FIG. 7** is a top view of a fourth embodiment of the invention.

[0021] and **FIG. 8** is a perspective view of a fifth embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0022] Referring to **FIGS. 1 and 2**, a magnetic head **10** for sensing a magnetic field is shown. A plurality of magnetic stripes **12** through **15** are spaced apart such as by nonmagnetic conducting stripes **16** through **19**. Magnetic stripes **12** through **15** and nonmagnetic stripes **16** through **19** are positioned adjacent one another, side by side, in electrical contact to one another on substrate **22**. Substrate **22** may be nonmagnetic and nonmetallic such as ceramic, glass, sapphire, quartz, magnesium oxide, semi-insulating such as silicon, silicon germanium, gallium arsenide, silicon-on-insulator or a polymer. Substrate **22** has a lower surface **23** upon which magnetic stripes **12** through **15** and nonmagnetic conductive stripes **16** through **19** are positioned. Magnetic stripe **12** is electrically coupled to electrode **26** which may, for example, extend along surface **23** and wrap around the end of substrate **22**. Nonmagnetic conductive stripe **19** is coupled to electrode **28** which may for example extend along surface **23** and wrap around the end of substrate **22** at the end opposite electrode **26**. Substrate **22** and electrode **26** may be supported by arm **29**. Electrode **28** and substrate **22** may be supported by arm **30**. Arms **29** and **30** function to position magnetic head **10** with respect to magnetic media **32** having an upper surface **33** as shown in **FIG. 1** such as transverse or 90° to magnetic media **32** as shown in **FIG. 2**. Magnetic media **32** may be for example a magnetic disk having a layer of magnetic material thereon suitable for storing information. Arms **29** and **30** may be rigid and in a fixed relationship to one another.

[0023] Magnetic stripes **12** through **15** may be made of soft magnetic material such as iron, nickel or alloys thereof having high permeability, low coercive force and small hysteresis loss so that anisotropy fields are small and do not dominate the saturation field of the respective magnetic stripe. The ends of magnetic stripes **12** through **15** are positioned with respect to one another to foster magnetostatic coupling between respective ends of magnetic stripes resulting in odd or even magnetic stripes **12** through **15** being magnetized in opposite directions to respective even or odd magnetic stripes as shown in **FIG. 2**. For example, magnetic stripes **12** and **14** are magnetized in a first direction shown by arrows **36** and **37** which are parallel and correspond to the longitudinal axis **38** and **39** respectively. Magnetic stripes **13** and **15** are magnetized in a second direction opposite to the first direction shown by arrows **42** and **43** which are parallel to the longitunal axis **44** and **45** respectively.

[0024] The magnetostatic coupling from a first end of magnetic stripe **13** is shown by arrows **48** and **49**. Arrow **48** represents the magnetostatic coupling to a first end of magnetic stripe **12** and arrow **49** represents the magnetostatic coupling to a first end of magnetic stripe **14**. Arrow **50** represents the magnetostatic coupling from a second end of magnetic stripe **12** to a second end of magnetic stripe **13**. Arrow **51** represent the magnetostatic coupling from a second end of magnetic stripe **14** to a second end of magnetic stripe **13**. Arrow **52** represents the magnetostatic coupling from a second end of magnetic stripe **14** to a second end of magnetic stripe **15**. Arrow **53** represents the magnetostatic coupling from a first end of magnetic stripe **15** to a first end of magnetic stripe **14**. Each magnetic stripe may have about equal magnetostatic coupling such as shown by arrows **48** and **49** to the adjacent magnetic stripes **12** and **14**. The number of magnetic stripes may be in the range from 2 to about 10,000. The magnetic stripes **12** through **15** are separated from one another by a distance such as 100 Å which is large enough so that they are not strongly antiferromagnetic exchanged coupled. The external magnetic field with the magnetostatic coupling as shown in **FIG. 2** corresponds to an applied magnetic field H of zero shown by arrow **55**. With opposite magnetic alignment of adjacent magnetic stripes **12** through **15**, magnetic head **10** is in a high electrical resistant state between electrodes **26** and **28**.

[0025] **FIG. 1** shows the low electrical resistant state of magnetic head **10** where magnetic stripes **12** through **15** are magnetized in the same direction as shown by arrows **57** in